

CLAIMS:

1. A valve for controlling flow of a primary fluid in a primary flow channel, which comprises:

a. a valve fluid channel,

b. a membrane of a porous dielectric material located in the channel so as to divide the channel into an inlet part and an outlet part and so that valve fluid flowing between the inlet and outlet parts flows through the said membrane,

c. first and second electrodes located for electrical communication with valve fluid in the inlet and outlet parts respectively of the valve fluid channel for application of an electric potential across the membrane in order to promote electro-osmotic flow of valve fluid through the membrane,

d. a valve member which can be displaced between open and closed positions as a result of valve fluid moving in the valve fluid channel through the membrane, into or out of the outlet part of the valve fluid channel, in which the valve member causes a reduction in the capacity for flow of the primary fluid in the primary flow channel when it is in the closed position compared with when it is in the open position.

2. A valve as claimed in claim 1, in which the outlet part of the valve fluid channel is closed so that fluid flowing into or out of the outlet part flows through the membrane.

3. A valve as claimed in claim 2, in which at least part of the wall of the outlet part of the valve fluid channel is defined by an expandable diaphragm.

4. A valve as claimed in claim 3, in which the diaphragm is provided by a resiliently deformable material.

5. A valve as claimed in claim 3, in which the diaphragm is provided by expandable bellows.

6. A valve as claimed in claim 3, in which the valve fluid channel has a side wall and an end wall, and in which the diaphragm is located on the side wall so that the channel can expand transversely in response to an increase in fluid pressure in the outlet part of the valve fluid channel.

5 7. A valve as claimed in claim 3, in which the outlet part of the valve fluid channel is located at least partially within the primary flow channel so that an increase in fluid pressure in the outlet part of the valve fluid channel causes the diaphragm to expand towards the wall of the primary flow channel to close the primary flow channel at least partially against flow of the primary fluid.

10 8. A valve as claimed in claim 7, in which the diaphragm expands transversely relative to the valve fluid channel, towards the wall of the primary flow channel.

9. A valve as claimed in claim 3, in which the valve fluid channel has a side wall and an end wall, and in which the diaphragm is located at the end wall so that the channel can expand longitudinally in response to an increase in fluid pressure in the outlet part of the valve fluid channel.

15 10. A valve as claimed in claim 9, in which the primary flow channel includes an orifice through which the primary fluid can flow, and in which the end wall of the valve fluid channel is located adjacent to the orifice so that, an increase in fluid pressure in the outlet part of the valve fluid channel causes the diaphragm to expand towards the orifice to close it at least partially against flow of the primary fluid.

11. A valve as claimed in claim 3, in which the valve member comprises a mandrel mounted on the diaphragm so that it is displaced when the diaphragm expands in response to an increase in fluid pressure in the outlet part of the valve fluid channel.

25 12. A valve as claimed in claim 3, in which primary flow channel comprises a tube which can be compressed transversely so as to reduce the cross-sectional area thereof, the said tube being located relative to the valve fluid channel so that it is compressed by the

action against it of the diaphragm when it expands in response to an increase in fluid pressure in the outlet part of the valve fluid channel.

13. A valve as claimed in claim 1, in which the valve member comprises a compressible tube which forms part of the primary flow channel, the compressible tube being located within a chamber which is in fluid communication with the outlet part of the valve fluid channel so that an increase in fluid pressure in the said chamber as a result of flow of valve fluid into the outlet part of the valve fluid channel can cause compression of the compressible tube, to reduce the flow of the primary fluid through the compressible tube.

14. A valve as claimed in claim 1, in which the inlet part of the valve fluid channel is closed so that fluid flowing into or out of the inlet part flows through the membrane.

15. A valve as claimed in claim 14, which includes a quantity of a valve fluid located within the valve fluid channel and a primary fluid in the primary flow channel, in which the compositions of the valve fluid and the primary fluid are different from one another.

16. A valve as claimed in claim 1, in which the inlet part of the valve fluid channel is in communication with the primary flow channel.

17. A valve as claimed in claim 1, which includes a valve member housing in which the valve member can move between the said open and closed positions.

18. A valve as claimed in claim 17, in which the valve member housing has a housing inlet and a housing outlet which communicate with the primary flow channel so that primary fluid flowing along the primary flow channel flows through the valve member housing, through the said housing inlet and housing outlet.

19. A valve as claimed in claim 18, in which the direction of flow of primary fluid through the valve member housing is generally transverse to the direction in which the valve member moves between its open and closed positions.

20. A valve as claimed in claim 17, in which the valve member is a close fit within the valve member housing so that a seal is formed between facing surfaces of the valve member and the valve member housing to minimise mixing of the primary fluid and the valve fluid.

5 21. A valve as claimed in claim 20, in which the valve member provides a flow path which can be aligned with the housing inlet and the housing outlet when the valve member is in the open position for the primary fluid to flow through the housing.

22. A valve as claimed in claim 21, in which the flow path is defined by a region of the valve member with a reduced cross-section.

10 23. A valve as claimed in claim 21, in which the flow path is defined by an aperture extending through the valve member.

24. A valve as claimed in claim 17, in which the valve member housing has a first end towards which the valve member moves when moving towards its open position from its closed position and an opposite second end towards which the valve member moves when
15 moving towards its closed position from its open position, and in which the valve member housing has a first opening at or towards the first end thereof which communicates with the inlet part of the valve fluid channel and a second opening at or towards the second end thereof which communicates with the outlet part of the valve fluid channel.

25. A valve as claimed in claim 1, which is incorporated as a driver valve in a pump
20 for controlling the flow of a primary fluid.

26. A pump for controlling flow of a primary fluid in a primary flow channel, which comprises:

a. a driver valve comprising:

i. a valve fluid channel,

5 ii. a membrane of a porous dielectric material located in the channel so as to divide the channel into an inlet part and an outlet part and so that valve fluid flowing between the inlet and outlet parts flows through the said membrane,

10 iii. first and second electrodes located for electrical communication with valve fluid in the inlet and outlet parts respectively of the valve fluid channel for application of an electric potential across the membrane in order to promote electro-osmotic flow of valve fluid through the membrane,

15 iv. a valve member which can be displaced between open and closed positions as a result of valve fluid moving in the valve fluid channel through the membrane, into or out of the outlet part of the valve fluid channel, in which the valve member causes a reduction in the volume of the primary flow channel when it is in the closed position compared with when it is in the open position,

20 b. an inlet valve located upstream of the driver valve, for controlling flow of primary fluid into the primary flow channel where it is acted on by the driver valve, and

c. an outlet valve located downstream of the driver valve, for controlling release of primary fluid from the primary flow channel where it is acted on by the driver valve.

27. A pump as claimed in claim 26, which includes a latching valve to control flow of the valve fluid in the valve fluid channel.

28. A pump as claimed in claim 27, in which the latching valve is a valve as claimed in claim 19.

29. A pump as claimed in claim 26, in which at least one of the inlet valve and the outlet valve comprises a valve as claimed in claim 1.